# SAWNWOOD VALUES AND SPECIES EFFECTS ON QUALITY: AN HISTORICAL PERSPECTIVE FOR BRITISH COLUMBIA

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## Summary

A review of sawnwood price studies as well as the use of a new data set to calculate historical price changes and a wood quality index for B.C. and Canada is presented. The data are used to calculate average annual rates of real price change. A review of previous studies on historical price growth rates and projected future rates is also presented. The range of price growth rates reported may be used as a reference when conducting financial sensitivity analyses of silviculture activities.

The volume weighted average of softwood prices in this analysis showed an average annual rate of increase of 0.53% in B.C. from 1926 to 1990, and -0.29% from 1965 to 1990. For Canada the rates for the two respective time periods were 0.24% and -0.24%. The species showing the highest growth rate since 1926 was hemlock, growing at an average of 1.56% per year. Ponderosa pine had the largest fall with an average decrease of 0.32% per year.

For the period beginning in 1965, six of the B.C. species and five of the Canadian species showed negative growth rates, compared to two and none over the 1926 to 1990 period. The highest rate in B.C. was 2.2% for Yellow Cypress. Lodgepole pine had the most significant decrease averaging -1.14% per year. As was the case in the previous period, hemlock had the highest rate in Canada. However, over this more recent time period its price growth rate was only 0.44%. Lodgepole pine decreased the most since 1965 with an average annual rate of change of -0.34%.

Historical and projected price growth rates vary among studies. The variation may be attributed to the different time periods over which the rates are calculated, as well as the different products and regions on which they are based. Although there is variation in the expected rates of future price changes, there is consensus that prices will increase at a decreasing rates. This is true for almost every study reviewed here regardless if the study covers B.C., the Pacific Northwest or the Southern U.S. It is also true across virtually all species and grades. There is no agreement, however, on whether prices of higher quality species and grades will increase at a rate which is faster or slower than prices of lower quality species and grades.

Historical rates in the studies reviewed range from a high of 3.45% for Douglas fir Grade 1 logs from the 1930s to the 1990s, to a low of -1.6% for hemlock lumber for the period 1965 to 1990.

Simons and Cortex project log and lumber price increases for Douglas-fir, hemlock, and balsam-fir to average less than 0.5% per year over the period 1990 to 2040 . Cedar log prices are expected to grow at a rate of 0.9% per year, with cedar lumber prices slightly lower at 0.6% per year. One hundred year forecasts used in the Reid Collins study range from 0.25% to 1.0%, depending on the species, under the minimum scenario. Under the average scenario the projected growth rates range from 1.0% to 3.5% depending on the species.

A species effect on wood quality index was also calculated in this analysis. From 1925 to 1990 the annual rate of decrease in wood quality attributable to the change in species composition

averaged 0.14 % for B.C. and 0.12% for Canada. The Haley and Constantino study (1988), on which this index was based, used log data from the Vancouver Log Market and found an average annual decrease of 0.28%. The divergence between the two studies may be attributed to technological change and its role in dampening the transmission of species composition effects from the log market to the lumber market. Substitution between species may account for some of the divergence as well.

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## Introduction

Past prices do not dictate what future prices will do. However, they represent a major piece of the information necessary for estimating their future expected values. The objective of this report is to present historical price information along with results from numerous price projection studies in order to provide a summary of information on past and expected rates of price change for logs and wood products. The range of price growth rates presented can serve as a reference when conducting financial sensitivity analyses of silviculture activities.

This study calculates real average annual rates of price change using historical data for B.C. and Canada from 1918 to 1990. The data were obtained from Statistics Canada publications catalogue number 35-204 for 1918 to 1984 and number 35-250 for 1985 to 1990. Price data was deflated to 1986 dollars and a constant conversion factor of 2.3597 was used to convert volume data given in Mbfm (thousands of board feet) to cubic metres.

An index for the species effect on wood quality changes was also calculated following Haley and Constantino (1988). The authors derive a version of the Tornquist index to measure wood quality change. It is decomposed into a species effect and a grade effect. Only the species effect component was measured in this analysis since grade data was not available for the span of this data set.

The Haley and Constantino method and results are presented first. Then, the species effect on wood quality index from this analysis is considered. Third, the historical deflated prices and price indices are evaluated. A summary of numerous studies on historical prices and price projections are then laid out in an annotated bibliography style for reference purposes. Finally, some comparisons and conclusions are made.

## The Species Effect on Wood Quality: Logs Versus Sawnwood

The purpose of the Haley and Constantino study was to construct a measure of wood quality in order to evaluate past quality trends and differences in quality changes across regions. Data from the Vancouver Log Market and the Pacific Northwest (PNW) log market were used. Their results support the hypothesis that wood quality in B.C. has been declining for most of this century.

Since logs are a factor input of a producer good (lumber), quality is a measure of the contribution the log input makes to the output of lumber. The theoretical base of the quality index they construct assumes lumber output is a function of labor, capital, sawlogs (L), energy inputs, and a time trend to capture technical progress. The sawlog aggregate, L, is a function of sawlog volume by grade, where the function transforms individual grade volumes into an aggregate

sawlog input[2]. That is, L is a "quality adjusted measure" of the sawlog volume input to lumber production, such that L changes as the composition of sawlog grades and species change.

Thus, they define wood quality as Q=L/V , where V is the total wood volume. Differentiating this equation with respect to t and rewriting it using the first order condition for profit maximization yields the index formula:

$$(1) \qquad \dot{Q} = \sum_{i=1}^{n} Z_i \dot{l}_i - \dot{V} = \dot{L} - \dot{V}$$

where $Z_i$ is the expenditure share on species i as a proportion of the total value of all species, $l_i$ is the growth rate of the volume of sawlogs of quality i (grade i), and a dot above a variable refers to the growth rate of that variable. Assuming a competitive market and profit maximizing firms, prices for the different log grades reflect their relative marginal products. The quality index in equation (8) is then split into a grade effect and a species effect as follows:

$$(2) \qquad \dot{Q}_g = \sum_{i=1}^{n} Z_i \dot{Q}_i$$

$$(3) \qquad \dot{Q}_s = \sum_{i=1}^{m} Z_i \dot{V}_i - \dot{V}$$

The above equations are for continuous data. The discrete version of equation (3) is given by

$$(4) \qquad \Delta \ln Q_s = \sum_{i=1}^{m} 0.5(Z_i^t + Z_i^{t+1}) \Delta \ln V_i - \Delta \ln V$$

This measures the change in wood quality between two periods due to changes in the species composition. See Haley and Constantino (1988) for the discrete approximation formulas for the total effect and grade effect.

Haley and Constantino's results support the hypothesis that wood quality in B.C. has been declining for most of this century. They found an average annual decrease in wood quality of 0.48% with a total decline of 25% from 1925 to 1980. The species effect constitutes about 58% of this decline for an average annual rate of change of -0.28%. Thus, the species component of the wood quality index fell a total of about 14% over this period.

A trend line for the Haley and Constantino species effect on log quality is inserted into figure 1. It is constructed using the average annual growth rates for four sub periods presented in their table. Because it is based on these sub period averages, the line will be smoother than that associated with the actual results. However, it does serve as a rough comparison to the species effect from this analysis plotted in the same figure.

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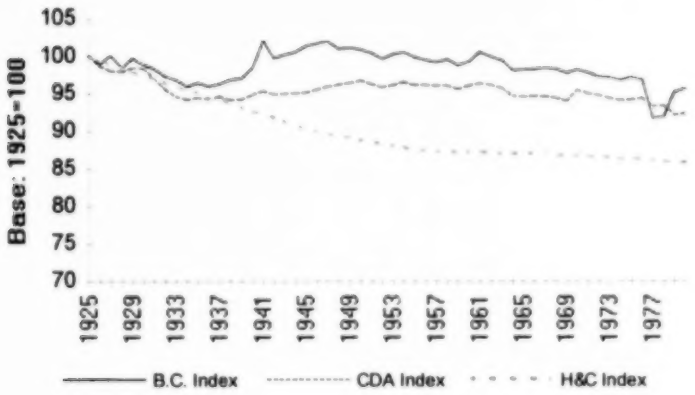
[2] The aggregator function is assumed to be linearly homogeneous

The extent of the fall in wood quality due to changes in species composition found in the Statistics Canada lumber data is not as great as that found by Haley and Constantino. An average annual rate of -0.14% was found for B.C. over the same time period. For Canada the rate was -0.12. The reason for this discrepancy likely stems from the fact that Haley and Constantino used log data, a factor input in the production of lumber, and this analysis is based on lumber output data. The key to this divergence lies in the role of technological change and the ability to make substitutions in the production process. Other factor inputs may be substituted for log inputs to produce an end-product grade mix that has declined less in overall quality relative to the

**Figure 1: Species Effect on Wood Quality Index**




log input grades. Improved processing technology that has provided better or more efficient use of the lower quality sawlogs also reduces the transmission of these quality affects from the log market to the lumber market. This evidence supports the hypothesis that there has been a significant historical role for technological change and substitution to compensate for declines in the species effect of wood quality.

## Historical Sawnwood Price Movements

The historical deflated price data is included in the Appendix. Average rates of change were calculated for each species and for the weighted average of all softwoods over two time periods. The first spans 1926 to 1990, the length of the GDP deflator data. The other starts in 1965, the starting date for the lumber price growth rates in the Simons and Cortex report reviewed below. These growth rates are shown in Table 1. The all-softwood B.C. growth rates were 0.53% and -0.29% for the two respective time periods. The rates for Canada were in the same range at 0.24% and -0.24%. The highest rate of real price increase since 1926 in B.C. was 1.56% for

hemlock. Ponderosa pine was the lowest with an average decrease of 0.32% per year. Hemlock also had the highest rate of increase for Canada at 1.31% over the same time period. There were no negative Canadian rates, although Spruce was essentially flat with a small positive rate of only 0.03%.

The picture is quite different for the period beginning in 1965. Six of the B.C. species and five of the Canadian species registered negative growth rates starting in 1965, compared to two and none over the 1926-1990 period. The highest B.C. rate was 2.22% for Yellow Cypress. Lodgepole pine had the most significant decrease averaging -1.14% per year. The high rate for the Canada data set was again achieved by hemlock, however it was only 0.44% per annum. As in B.C., Lodgepole pine had the lowest rate at -0.34%.

**TABLE 1 Average Annual Growth Rates of Deflated Species Prices**

| | SPRU | SSPR* | DF | HEM | WHP | CED | LJ | TW | BF | REP | PP | YCY | AV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CDA** | | | | | | | | | | | | | |
| 1926-1990 | 0.03 | | 0.83 | 1.31 | 0.57 | 0.50 | 0.10 | 0.59 | 0.05 | 0.56 | 0.27 | 0.25 | **0.24** |
| 1965-1990 | -0.32 | | 0.12 | 0.44 | 0.06 | 0.17 | -0.34 | -0.09 | 0.02 | 0.01 | -0.46 | -0.18 | **-0.24** |
| **B.C.** | | | | | | | | | | | | | |
| 1926-1990 | 0.27 | | 0.55 | 1.56 | 0.80 | 0.48 | -0.11 | 0.28 | 1.54 | | -0.32 | 1.03 | **0.53** |
| 1965-1990 | -0.47 | -5.25 | -0.41 | 1.24 | 0.08 | 0.45 | -1.14 | -1.07 | 1.27 | | -1.17 | 2.22 | **-0.29** |

AV=weighted average of all species LJ=Lodgepole/Jack Pine TW=Tamarack & Western Larch

BF=Balsam Fir HEM=Hemlock YCy=Yellow Cypress WhP=White Pine SPRU=Spruce

DF=Douglas Fir CED=Cedar PP=Ponerosa Pine ReP=Red Pine SSPR=Sitka Spruce

*1978-1990

The deflated prices for each species are plotted with the all-softwood average in figures 2 to 12 in the Appendix. These graphs allow trends in sub periods to be seen which are not revealed by an average annual rate.

## Review of Previous Studies

Sohngen, Brent L. and Haynes, Richard W. (1994). **The "Great" Price Spike of '93: An Analysis of Lumber and Stumpage Prices in the Pacific Northwest**. Research Paper PNW-RP-476, United States Department of Agriculture, August 1994.

Sohngen and Haynes evaluate the interaction of lumber and stumpage prices of Coastal Douglas-fir in the Pacific Northwest using annual data from 1910 to 1992. Using the lumber price data given in their Appendix, average annual price increases are calculated. The average annual rate for 1965 to 1990 was -0.26% which is in the same range as the B.C. rate of -0.41% found in this analysis. The P.N.W. growth rate for the period from 1926 to 1990 was 1.04%, about twice the B.C. rate of 0.55%.

The authors found that, contrary to economic theory, the lumber and stumpage prices did not always move together. These occurrences are exemplified by the price movements in 1993.

Most of the "erratic" price behaviour was said to be due to consumer confidence as a result of potential political moves over environmental concerns. Actual policy changes also played a role. *A priori* expectations were that stumpage prices would fluctuate more than lumber prices since small changes in the lumber markets are expected to translate into larger changes in the stumpage markets. However, their lumber prices exhibited greater fluctuations than the cut stumpage prices.

They explain the apparent discrepancy in terms of the elasticity of price transmission between lumber and stumpage, and the fact that stumpage prices are lower than lumber prices. Haynes (1977) determined the elasticity of price transmission for pre-1977 data in his study to be 0.38. This implies that a $1 change in the price of lumber led to a $2.63 change in the stumpage price. Sohngen and Haynes calculated the same elasticity for their data set and found it to be essentially the same as Haynes (1977); a 1 per cent change in lumber prices led to a 2.5 per cent change in stumpage prices. Because stumpage rates are lower, a lower absolute change in stumpage prices can generate the same relative change in stumpage markets as in lumber markets.

Sedjo, Roger A. (1990). **The Nation's Forest Resources**. Discussion Paper ENR90-07, Energy and Natural Resources Division, Resources for the Future, Washington, D.C.

Sedjo found no significant increase in real prices since the 1950s for most major wood groups in the United States. Lumber prices slowed from an average annual increase of 3% between 1805 and 1950 to a total increase of less than 10% between 1950 and 1986. Southern pine sawlogs and pulpwood were found to be relatively flat in recent history as well. Douglas fir was the only species noted for a slightly more significant increase.

The author suggests that the long period of significant price increases prior to 1950 "was the exception and not the rule," referring to long-term price stability for natural resources being the rule. The pre-1950 increases were attributed to demand exceeding supply even when demand growth was insignificant. The settling down of real price increases was the result of a fundamental change in the balance between demand and supply in the wood market.

Binkley, Clark S. and Vincent, Jeffrey R. (1988) **Timber Prices in the U.S. South: Past Trends and Outlook for the Future.** SJAF 12(1988).

Binkley and Vincent assess historical price trends for southern U.S. softwood sawtimber. Seven notable forecasts of forest product prices are also reviewed. The historical assessment reveals that softwood lumber production has fallen since the turn of the century, but it has been offset by increases in sawtimber for plywood and pulpwood production resulting in an overall increase in harvest of softwood sawtimber. However, the amount supplied has fallen relative to demand resulting in higher real prices of softwood sawtimber.

The rates of price increases are substantially higher than those of other studies. This may be explained by the fact that Binkley and Vincent use real *stumpage* prices. From 1910 to WWII southern pine stumpage prices rose at a rate of about 4.6% per annum and then increased somewhat slower after WWII at about 3.1% per annum. In order to put these rates in some sort

of context, stumpage prices and lumber prices for P.N.W. Douglas-fir were compared using data from the Sohngen and Haynes study reviewed above. Stumpage price growth rates averaged about 3 percentage points higher than lumber prices. This would imply the growth rates found by Binkley and Clark are not necessarily out of line with the other studies reviewed here.

One of the price projection studies reviewed by Binkley and Clark was conducted by the International Institute for Applied Systems Analysis (IIASA;1987). Over 100 collaborators in 25 countries evaluated production, consumption and trade in 18 regions of the world. The study by Resources for the Future (RFF; Sedjo and Lyon 1986) evaluates trade in industrial wood using a single demand function with no production model. Three of the studies surveyed were done by the USDA Forest Service in 1979, 1983 and 1987, and were based on the Timber Assessment Market Model by Adams and Haynes (1980). All five of the above studies assumed softwood lumber is a homogeneous good and traders make adjustments so as to minimize total production costs.

A study by Resource Information Systems Inc (RISI; 1986) is also presented. Behavioural market-share equations based on delivered price differentials were used to model inter-regional trade, and to assess product preferences and short-term adjustments in prices, production and capacity. Although supply is expected to fall, the effect on prices is partially offset by lower demand projections for sawtimber. The following table presents a summary of the real rates of change in pine stumpage prices found by the different studies. The average of these forecasts is 2.5% per year for the period 1990 to 2010 with a median estimate of 1.9%.

**TABLE 2 Price Growth Rates (Binkley and Vincent)**

| Study | 1980s-2000s | 1990s-2010s |
|---|---|---|
| IIASA Base | 3.4 | 2.3 |
| USDA 1979 | 5.3 | 2.2 |
| USDA 1983 | 3.9 | 1.7 |
| USDA 1987 | 2.5 | 2.5 |
| RISI | 2.1 | 1.5 |
| RFF Base | 0.5 | 0.4 |
| RFF High Demand | 2.5 | 1.9 |
| median of all studies | 2.5 | 1.9 |

Although there is consensus among these studies that real prices will increase at a decreasing rate, there is variation in the rate at which these changes are expected to occur. Lows of 0.4% and 0.5% for the 1980s to 2000 and the 1990s to 2010, respectively, were forecast by RFF. The highest projections, 5.3% and 2.2% for the two respective time periods, are from the dated 1979 USDA study.

H.A. Simons Strategic Services Division and Cortex Consultants Inc. (1993). **Historical and Future Log, Lumber, and Chip Prices in British Columbia.** Canada-British Columbia Partnership agreement on Forest Resource Development: Simons and Cortex. Report #207.

The Simons and Cortex report evaluates historical prices of log, lumber, and chip products in B.C. and presents forecasts of these timber product prices. Historical log price data for the coast consists of prices by species and grade from the Vancouver Log Market (VLM). Their composite average series shows coastal log prices have had an upward trend of 0.3% per year from 1965 to 1991. This trend consists of rapid increases of 3.9% in the 1970s, due to high lumber demand surpassing lumber capacity, followed by extreme price falls in 1981 and 1982 as capacity was increased to accommodate the higher demand. The authors note that demand also continued to increase during this time, but it was surpassed by the increase in supply thereby facilitating the real price fall.

A study by Sedjo and Lyon (1990), cited in this report, evaluates prices of industrial roundwood between 1950 and 1985. Although their average growth rate for the entire period was also 0.3 %, the average for the 1970s was 4.5%.

The Simons and Cortex assessment of prices by species was done in terms of three grade "bundles": high-grade sawlog and peeler logs, average-grade oversized sawlogs, and average-grade undersized and utility sawlogs and chipper logs. Prior to 1979 prices for different grades of Douglas-fir moved together maintaining constant premiums. After 1979, bundle 1 prices increased significantly, but the average price did not since the grade 1 bundle did not comprise a significant proportion of the total. These higher quality logs are decreasing in supply in B.C. as more second-growth replaces old growth in harvesting. They recommend such premiums and supply shifts be considered in determining future price expectations.

Coastal lumber prices were obtained from Random Lengths Yearbooks for the years 1965 to 1991. The weighted average price growth rates were based on selected product categories depending on the species. The categories for Douglas fir were 2x4 Std&Btr, 2x10 #2&Btr, 4x4, and 2x6 &wdr (clears). The average annual rate of change was 0.0%, with only the clear lumber grade having positive growth. An average rate of -1.6% was found for the following hemlock products: 2x4 Std&Btr, 2x10 #2&Btr, and clears. The average rate for five selected cedar products, starting in 1974, was -1.6%. These rates are presented in Table 3 along with results from this analysis and those of other studies reviewed. It should be pointed out that the data set in this analysis includes all of B.C. and the prices are for total sawnwood, whereas the Simons and Cortex rates are for the coast only and represent a weighted average of selected products. The values in the table are, thus not exactly comparable.

The limited information that is given for interior lumber prices indicates that Douglas-fir board and dimension prices declined over the 26 year period, and that all lumber product prices of spruce-pine-fir declined over this period as well; no rates of decrease are given. Interior log prices were obtained from delivered wood costs given in RISI's FORSIM reports. As on the coast, log prices in the interior increased dramatically in the 1970s and then had a rapid fall in the early 1980s. Over the period 1970 to 1991 prices declined at an average rate of 0.1% per year.

Regression analysis and simulation methods were used to forecast coastal log and lumber prices. The log and lumber price equations were estimated as a system of seven equations using Zellner's

Seemingly Unrelated Regression Equations method[3]. The log price for a given species was

[3]There were four log price equations and three lumber price equations in the system

**TABLE 3: Average Annual Price Changes**

| AUTHOR<br>REGION<br>TYPE<br>YEARS | Reid,Coll.<br>BC Coast<br>Logs<br>1930/9-90/2 | S&CORTEX<br>BC Coast<br>Logs<br>1965-91 | S&CORTEX<br>BC Coast<br>Lumber^<br>1965-91 | MOF96<br>B.C<br>Lumber^^<br>1965-90 | MOF96<br>B.C<br>Lumber^^<br>1926-90 | MB<br>BC Coast<br>Appear. logs<br>1947-92 |
|---|---|---|---|---|---|---|
| **Douglas-fir** | | | | | | |
| Grade 1 (D) | 3.45 | | | | | 1.9 |
| Grade 2 (H &F,I,J) | 1.91 | | | | | |
| Grade 3 (I & U) | 0.93 | | | | | |
| Average | | 0.2 | 0.0 | -0.41 | 0.55 | |
| **Hem** | | | | | | |
| Grade 1 | 0.86 | | | | | 0.80 |
| Grade 2 | 0.33 | | | | | |
| Grade 3 | -0.24 | | | | | |
| Average | | -0.3 | -1.6 | 1.20 | 1.60 | |
| **Bal** | | | | | | |
| Grade 1 | 0.86 | | | | | 1.20 |
| Grade 2 | 0.33 | | | | | |
| Grade 3 | -0.24 | | | | | |
| Average | | 0.1 | | 1.30 | 1.50 | |
| **Cedar** | | | | | | |
| Grade 1 | 0.72 | | | | | 0.3 |
| Grade 2 | 0.93 | | | | | |
| Grade 3 | 0.68 | | | | | |
| Average | | 1.2 | -1.6 | 0.45 | 0.48 | |
| Spruce | | 2.8 | | -0.47 | 0.27 | |
| Sitka Spruce | | | | -5.25* | | 4.3 |
| White Pine | | | | 0.08 | 0.80 | |
| Lodg. Pine | | | | -1.14 | -0.11 | |
| Tam/WLa | | | | -1.07 | 0.28 | |
| Pond.Pine | | | | -1.17 | -0.32 | |
| Yellow Cyp. | | -1.0 | | 2.22 | 1.03 | 4.7** |
| Average | | | | -0.29 | 0.53 | |

The results in this table represent a range of rates that have been found for different products. The rates from different studies are thus not exactly comparable. Time periods, products, and regions used in the different studies should be noted.

^Lumber in the Simons and Cortex report refers to the average of selected products depending on the species

^^Lumber from MOF96 includes all sawnwood

**only for the period 1974-92

*only for the period 1978-90

regressed on the following variables: the lumber price for the species under consideration, labour productivity, mature timber inventory and real wage rates. The lumber price for a given species was regressed on demand and supply variables such as sawmilling capacity, housing starts, wage rates, a producer price index and a time trend proxy for technological change[4]. OLS was used to estimate the log prices for the different grade bundles. For a given species the average log price projections were used along with the historic price differential and a measure of the relative scarcity of the grade of interest within that species.

Forecasts for the explanatory variables were obtained from numerous sources. The resulting price projections are given in table 4 along with the projections from Reid,Collins Associates discussed below. Over the period 1990 to 2040 the average annual log and lumber price increases for Douglas-fir, hemlock, and balsam-fir are forecast to be less than 0.5%. Cedar log prices are expected to grow at a rate of 0.9% per year and lumber prices at 0.6% per year.

Reid, Collins and Associates. (1993) **Impact of Silvicultural Regimes on Future Timber Quality in the Vancouver Forest Region, Phase II: Price Projections**

Historical Vancouver Log Market data compiled by the Revenue Branch was used to find the average price growth rates over the period from 1930-39 to 1990-92[5]. For Grade 1 Douglas-fir logs the 20 year low of 0.1%, for 1950-59 to 1970-79, was taken to be the growth rate for the *minimum* scenario. Grade 2 log growth rates were then subjectively assigned a rate equal to half of the Grade 1 rate, yielding an expected average annual change of 0.5%. The real rate of price increase for Grade 3 logs was "estimated" to be 0.25%, but how this was estimated is not given. The authors concede these rates are somewhat arbitrary. The *average* scenario projections simply use the 60 year historical averages. These were 3.5%, 2.0% and 1.0% for Grades 1,2 and 3 respectively.

Cedar and hemlock/balsam fir price projections were derived by applying the historical price ratios to the above Douglas-fir forecasts in order to maintain past price premium growth rates. The price projections for the three species groups and grade categories are shown in table 4. Their price projections reveal a scenario in which cedar and higher-quality logs increase at a faster rate than low quality logs such as those harvested from second growth stands. The authors do not recommend using a single rate of price change in silviculture investment analysis since the rates were found to vary between species, grades and geographical area.

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[4] A composite average lumber price is used for Douglas-fir. 2x4 Std and better prices are used for cedar and hemlock, and spruce-pine-fir 2x4 Std and better is used for the interior indicator.

[5] The real rates of price increases for this data can also be found in Simons Reid Collins (1996) Draft of A Review of the Economics of Commercial Thinning in B.C.

**TABLE 4: B.C. Coast Price Projections**

| | S&Cortex Projections | | | | | | Reid Collins Projections | |
|---|---|---|---|---|---|---|---|---|
| | 1990/2000 | 2000/10 | 2010/20 | 2020/30 | 2030/40 | 1990/2040 | 100 year forecasts | |
| **DF Log** | **1.4** | **0.1** | **0.4** | **0.1** | **0.1** | **0.4** | min | av |
| Grade 1 | 2.5 | 0.4 | 0.6 | 0.2 | 0.2 | | 1.00 | 3.50 |
| Grade 2 | 1.5 | 0.1 | 0.4 | 0.1 | 0.1 | | 0.50 | 2.00 |
| Grade 3 | 1.3 | 0.1 | 0.3 | 0.1 | 0.1 | | 0.25 | 1.00 |
| **Ced Log** | **3.8** | **-0.7** | **0.5** | **0.3** | **0.3** | **0.9** | | |
| Grade 1 | 3.8 | -0.2 | 0.6 | 0.4 | 0.3 | | 0.70 | 2.10 |
| Grade 2 | 4.8 | -0.2 | 0.7 | 0.5 | 0.4 | | 0.3-0.5 | 1.0-2.0 |
| Grade 3 | 3.2 | -0.2 | 0.3 | 0.1 | 0.2 | | 0.25 | 1.00 |
| **Hem Log** | **0.2** | **-0.6** | **0.1** | **0.1** | **0.1** | **0.0** | **Hem/Bal** | |
| Grade 1 | 0.3 | -0.4 | 0.7 | 0.6 | 0.5 | | 0.70 | 2.10 |
| Grade 2 | 0.3 | -0.3 | 0.3 | 0.3 | 0.3 | | 0.3-0.5 | 1.0-2.0 |
| Grade 3 | 0.2 | -0.7 | 0.1 | 0.1 | 0.1 | | 0.25 | 1.00 |
| **Bal Log** | **0.8** | **-0.2** | **0.3** | **0.1** | **0.1** | **0.2** | | |
| Grade 1 | 1.3 | 0.2 | 0.5 | 0.2 | 0.2 | | | |
| Grade 2 | 0.9 | 0.5 | 0.7 | 0.4 | 0.3 | | | |
| Grade 3 | 0.8 | -0.2 | 0.3 | 0.1 | 0.1 | | | |
| **DF Lumb.** | **1.9** | **-1.3** | **0.3** | **0.3** | **0.3** | **0.4** | | |
| **Ced Lumb.** | **2.1** | **-1.1** | **0.3** | **0.3** | **0.3** | **0.6** | | |
| **Hem Lumb.** | **1.1** | **-1.0** | **0.2** | **0.2** | **0.2** | **0.1** | | |

Haynes, Richard W., Fahey, Thomas D. and Fight, Roger D. (1988) **Price Projections For Selected Grades of Douglas-fir Lumber.** Research Note PNW-RN-473, United States Department of Agriculture, May 1988.

Seven grade categories were constructed and price projections were made for each category. Douglas-fir lumber production and price data was obtained from Western Wood Products Association reports for 1971-1986. Lumber grade categories were first delineated. Then, existing price projections for Douglas-fir were disaggregated into these categories assuming the projections were a volume-weighted average of the individual species and grade prices.

Next, historical data was used to estimate the relationship between the dominant grade and the other grades. Each species\grade price was regressed on the price of the dominant species\grade price and on the proportion of total lumber from the species\grade of interest[6]. The resulting forecasts for the period 1986 to 2030 range from a low of 0.73% increase in price per year for D selects and shop to a high of 1.42% for Structural items. The dominant grade for Douglas-fir in this region, light framing, had an annual rate of price growth of 1.31%. The authors further

[6]The proportion of total lumber produced from the species\grade of interest is used as a proxy for the scarcity of that species\grade

conclude that Douglas-fir lumber will maintain its price premium relative to other species. Higher
quality grades that are becoming more scare are expected to have higher than average rates of price increase; lower quality grades are expected to have lower than average rates of price increase.

Haynes, Richard W. and Fight, Roger D. (1992). **Price Projections for Selected Grades of Douglas-Fir, Coast Hem-Fir, Inland Hem-Fir, and Ponderosa Pine Lumber**. Research Paper PNW-RP-447, United States Department of Agriculture, February 1992.

Haynes and Fight present both historical data and projections for lumber prices by grade categories for Douglas-fir, coast hem-fir, and ponderosa pine in the Pacific Northwest. The historical data is from Western Wood Products Association (1989) reports and price projections are from the (1989) Resources Planning Act timber assessment by Haynes (1990). They do not report the price growth rates in this study, but these are calculated from the price values reported in their tables. The rates for selected grades of Douglas-fir and Coastal hem-fir are presented in table 5.

**TABLE 5: Haynes and Fight P.N.W Lumber Price Projections**

| | 1989/2000 | 2000/10 | 2010/20 | 2020/30 | 2030/40 | **1990/2040** |
|---|---|---|---|---|---|---|
| **Douglas-fir** | | | | | | |
| D selects & shop | 0.56 | 1.42 | 1.83 | 2.15 | 2.00 | **0.40** |
| Heavy Framing | 1.39 | 1.55 | 0.74 | 0.55 | -0.26 | **0.79** |
| Light Framing | 2.04 | 1.55 | 0.74 | 0.54 | -0.25 | **0.92** |
| Utility | 2.40 | 1.53 | 0.78 | 0.55 | -0.25 | **1.00** |
| **Coast Hem-fir** | | | | | | |
| D selects & shop | 0.89 | 0.85 | 0.41 | 0.31 | -0.20 | **0.45** |
| Heavy Framing | 1.42 | 1.34 | 0.62 | 0.45 | -0.28 | **0.71** |
| Light Framing | 1.85 | 1.53 | 0.71 | 0.50 | -0.33 | **0.85** |
| Utility | 2.22 | 1.77 | 0.80 | 0.59 | -0.39 | **0.99** |

The methodology is essentially the same as the 1988 study by Haynes, et al, outlined above. Douglas-fir is grouped into seven categories as in the 1988 study. Two of the categories are regarded as high-quality and another two are above average. Grade distribution of Douglas-fir and coast hem-fir lumber have been shifting from higher grades and the utility grade to light and heavy framing grades. This move from high to lower quality grades is also evident with the Inland hem-fir and Ponderosa Pine. Since high price incentives exist for the high quality grades the authors suggest that the fall in its production is a result of a fall in the quality of timber being harvested. Projected volumes of grades and their distribution are based on this recent trend of declining supply of high quality timber and were forecasted independently of price projections.

The results are said to support the hypothesis that increasing scarcity of high-quality material will result in higher prices. However, contrary to the 1988 study, they expect higher grade prices to increase at a lower rate than low quality grades. They assume price arbitrage and substitution will limit the amount the price for a given species and grade can increase.

MacMillan Bloedel Limited (1995). **Log Prices: The Relationship Between Log Price, Log Size and Log Quality**. Corporate Forestry, October 24, 1995.

MacMillan Bloedel (MB; 1995) makes second growth log price projections for five major species in coastal B.C. The projections are done in terms of the age of a given grade and species and are based on size and juvenile wood assumptions at each age. The historical average annual price increases for second growth Grade 1 Appearance Logs from 1947 to 1992 were as follows: Douglas-fir, 1.9%; Sitka spruce, 4.3%; Western Red Cedar, 0.3%; Yellow Cypress, 4.7% (for 1974 to 1992); Western Hemlock, 0.8%; and Balsam fir 1.2%.

The following steps were used to develop their age price projections: estimate the lowest and average commodity log price for each species; estimate the relationship between diameter, wood density, and juvenile wood; estimate the average appearance log price for each species; and estimate the relationship between diameter and recovery for appearance products. Rates of real price increase are not given and they cannot be calculated from the information given. In general, they expect B.C. appearance log prices to flatten. Price trends for structural logs are also expected to be level. Moreover, engineered wood product growth over the next fifty years is expected to substantially reduce the premium for diameter and volume recovery.

MacMillan Bloedel Limited (1994). **Future World Sawlog Prices: A Review of the Underlying Economic Factors and Alternative Approaches.** Corporate Forestry, Jan.18 1994.

The objective of the MB (1994) paper was to evaluate the underlying assumptions of different log price projections and contradictions that exist between them. Five different projections are discussed: a population-driven forecast by MB, the GDP approach from the FAO, the Timber Supply Model (TSM), the Global Trade Model (GTM), and a forecast by Jaakko Poyry (JP). Under the TSM model, log prices are expected to rise 0.2% per year over the next several decades. Price projections from the GTM model range from 0.5% to 2.0% depending on the country. Rates of real price increases are not given for the other studies mentioned. The author of this paper argues that the most reliable price projections, although only for North American markets, come from Resource Information Systems, Inc. (RISI). Although rates are not given, RISI is said to expect prices to return to their long-term trend after a short-term rise. MB supports the view that there will be "an adequate physical stock of timber and constant real prices, rather than one of a short supply and increasing prices" (p.i).

## Conclusions

Historical and projected price growth rates vary among studies. Much of the variation can be explained by the different time periods over which the rates are calculated, as well as the different products and regions on which they are based. Although there is variation in the rates of future price changes, there is consensus that prices will increase at a decreasing rates. This is true for almost every study reviewed here regardless if the study covers B.C., the Pacific Northwest or the Southern U.S. It is also true across virtually all species and grades.

Historical rates in B.C. ranged from a high of 3.45% for Douglas fir Grade 1 logs from the 1930s to the 1990s in the Reid Collins study to a low of -1.6% for Hemlock lumber from 1965 to 1990 according to the Simons and Cortex report. Price projections varied less than the historical rates from the same two studies. Forecasts for Douglas fir, Cedar, and Balsam fir log and lumber price changes were all between 0.0% and 0.9% in the Simons and Cortex report. The Reid Collins projections vary from 0.25% to 3.45% depending on the species and grade, and on whether it is the average scenario or the minimum scenario. The Haynes and Fight P.N.W. lumber price projections for Douglas fir and Coastal Hemlock fir were between 0.40% and 1.0%.

Although there is consensus that prices will increase at a decreasing rate, the rate at which these movements will occur varies among studies. Moreover, there does not seem to be agreement on whether prices of higher quality species and grades will increase at a rate which is faster or slower than prices of lower quality species and grades.

No single rate can be concluded to be "the" real rate of price increase. This paper serves as a summary of a range of rates. Rates to be used for sensitivity analysis of silviculture activities will depend on the region, time period, species and end products applicable to the study under consideration.

Decreases in wood quality found to exist in the lumber market due to changes in species composition are less than those found in log markets. The smaller magnitude of the species effect on wood quality may be attributed to technological change and substitution in production. These factors will play a role in future price movements and should be considered in the evaluation of price expectations.

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# APPENDIX
# DEFLATED SPECIES PRICES: GRAPHS AND DATA

## Deflated Species Prices (Average Annual Price Change, %, in Parentheses)

**Figure 2: Spruce (0.27%), Average (0.53%)**

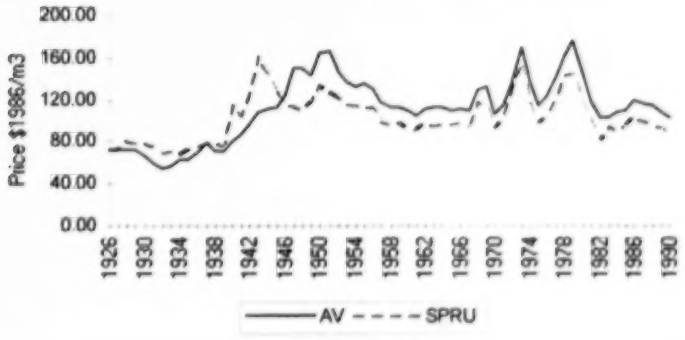



**Figure 3: Sitka Spruce (-5.25%), Average (-4.8%)**

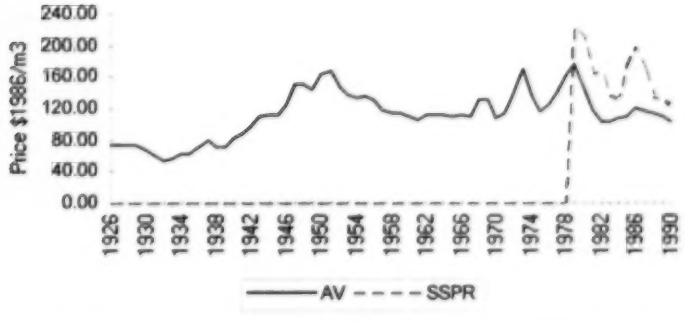


Figure 4: Douglas-fir (0.55%), Average (0.53%)

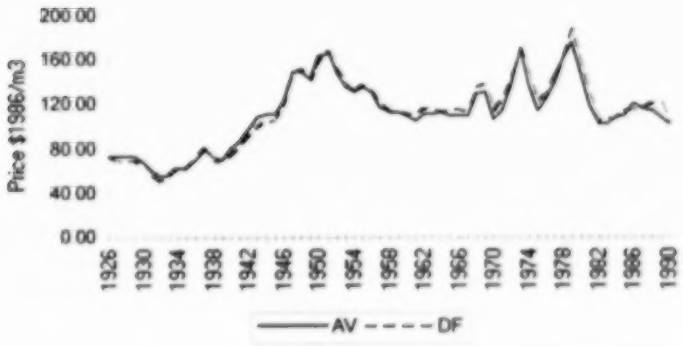



Figure 5: Hemlock (1.56%), Average (0.53%)

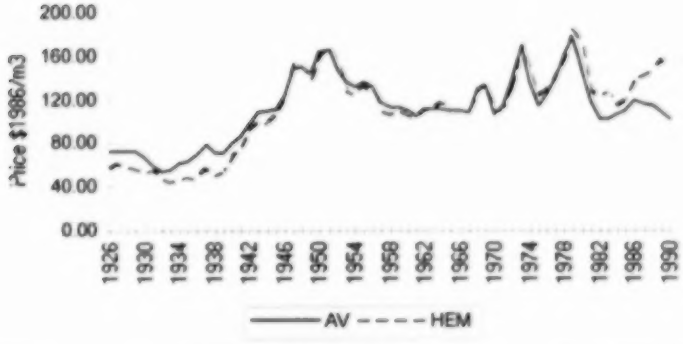



Figure 6: White Pine (0.80%), Average (0.53%)

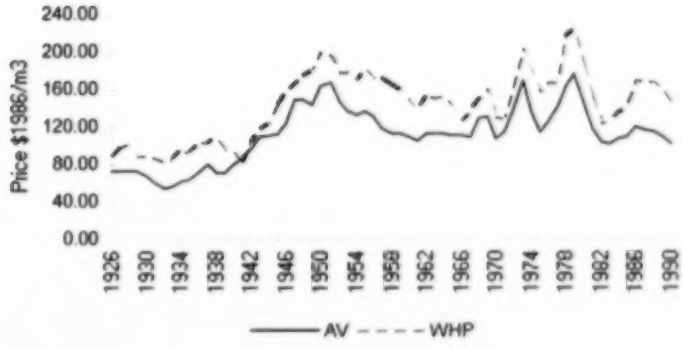


Figure 7: Cedar (0.48%), Average (0.53%)

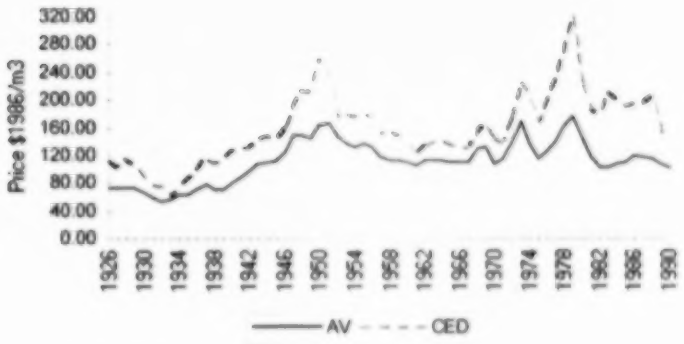



Figure 8: Lodgepole/Jack Pine (-0.11%), Average (0.53%)

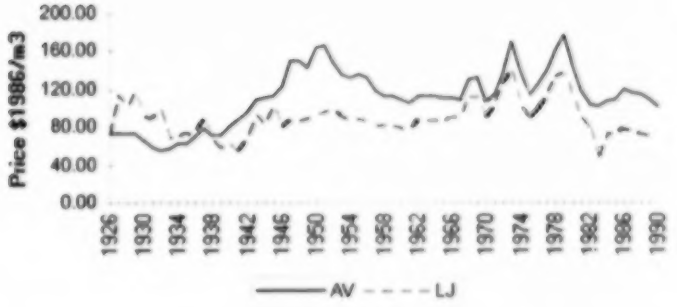



Figure 9: Tamarack/Western Larch (0.28%), Average (0.53%)

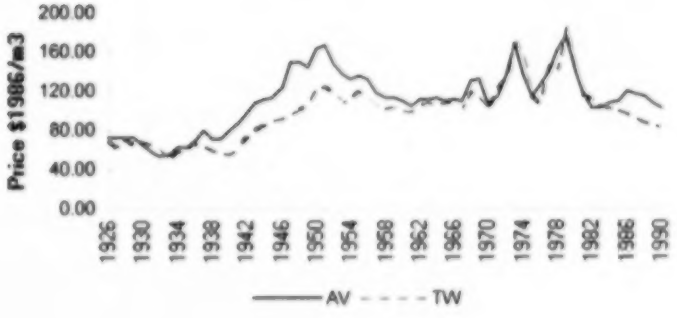


Figure 10: Balsam-fir (1.54), Average (0.53)

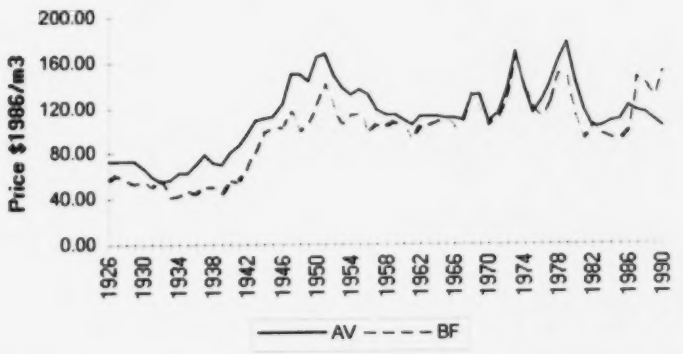



Figure 11: Ponderosa Pine (-0.32%), Average (0.53%)

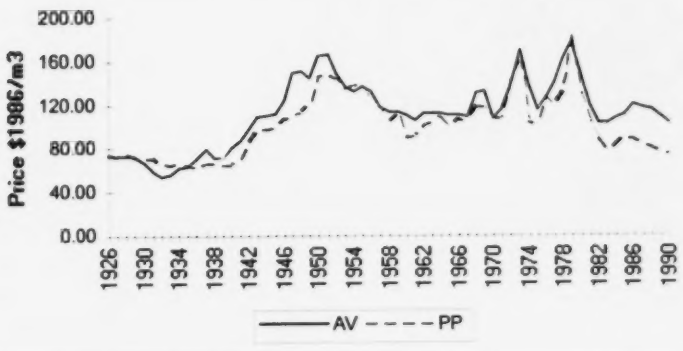
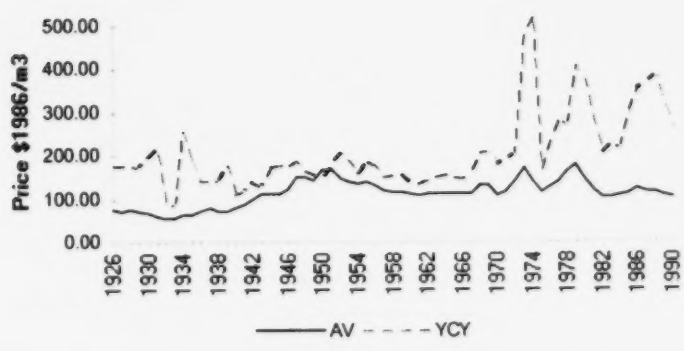



Figure 12: Yellow Cypress (1.03%), Average (0.53%)



**B.C. DEFLATED SPECIES PRICES**

| YEAR | AV | SPRU | SSPR | DF | HEM | WHP | CED |
|---|---|---|---|---|---|---|---|
| 1926 | 73.08 | 73.05 | 0 00 | 72.66 | 56.73 | 86.91 | 111.90 |
| 1927 | 72.54 | 72.58 | 0 00 | 70.17 | 62.76 | 98.46 | 103.39 |
| 1928 | 73.15 | 81.13 | 0 00 | 70.56 | 59.38 | 102.47 | 113.72 |
| 1929 | 72.88 | 79.71 | 0 00 | 70.61 | 57.97 | 88.84 | 105.10 |
| 1930 | 66.52 | 78.60 | 0 00 | 64.43 | 53.66 | 88.92 | 87.63 |
| 1931 | 59.55 | 75.50 | 0 00 | 55.73 | 56.33 | 86.68 | 77.80 |
| 1932 | 54.54 | 68.69 | 0 00 | 51.08 | 50.20 | 83.52 | 74.74 |
| 1933 | 56.37 | 70.20 | 0 00 | 56.18 | 44.81 | 85.61 | 60.32 |
| 1934 | 62.47 | 67.40 | 0 00 | 64.58 | 46.09 | 96.05 | 72.02 |
| 1935 | 63.12 | 72.49 | 0 00 | 62.97 | 49.38 | 93.42 | 86.64 |
| 1936 | 70.01 | 75.50 | 0.00 | 72.30 | 47.67 | 103.94 | 98.27 |
| 1937 | 79.33 | 79.71 | 0.00 | 81.29 | 57.35 | 103.50 | 116.28 |
| 1938 | 71.34 | 79.53 | 0.00 | 70.91 | 51.40 | 109.18 | 108.88 |
| 1939 | 70.67 | 76.10 | 0.00 | 69.11 | 55.03 | 96.48 | 114.03 |
| 1940 | 80.42 | 114.51 | 0.00 | 74.62 | 68.83 | 93.62 | 126.00 |
| 1941 | 87.28 | 102.76 | 0.00 | 80.68 | 75.40 | 81.55 | 131.24 |
| 1942 | 97.20 | 126.13 | 0.00 | 90.94 | 92.51 | 103.54 | 130.96 |
| 1943 | 108.64 | 161.71 | 0.00 | 99.15 | 99.67 | 116.15 | 142.55 |
| 1944 | 110.74 | 142.44 | 0.00 | 104.77 | 98.81 | 124.36 | 147.93 |
| 1945 | 112.18 | 128.11 | 0.00 | 106.29 | 106.61 | 143.08 | 142.60 |
| 1946 | 123.59 | 114.93 | 0.00 | 120.23 | 123.27 | 156.87 | 159.89 |
| 1947 | 149.35 | 115.05 | 0.00 | 149.50 | 155.59 | 165.64 | 193.91 |
| 1948 | 149.80 | 109.46 | 0.00 | 152.15 | 150.60 | 173.70 | 213.47 |
| 1949 | 143.51 | 117.34 | 0.00 | 140.84 | 137.98 | 180.20 | 213.72 |
| 1950 | 163.75 | 134.52 | 0.00 | 158.08 | 159.59 | 200.76 | 258.12 |
| 1951 | 166.43 | 127.79 | 0.00 | 167.90 | 167.72 | 195.95 | 234.54 |
| 1952 | 147.39 | 122.33 | 0.00 | 151.41 | 155.29 | 178.81 | 172.57 |
| 1953 | 136.60 | 115.65 | 0.00 | 138.94 | 128.11 | 177.70 | 181.92 |
| 1954 | 132.00 | 113.82 | 0.00 | 131.76 | 125.86 | 169.73 | 176.17 |
| 1955 | 136.03 | 113.65 | 0.00 | 136.76 | 133.24 | 182.72 | 181.14 |
| 1956 | 131.40 | 112.11 | 0.00 | 132.82 | 128.08 | 173.31 | 176.33 |
| 1957 | 117.43 | 100.22 | 0.00 | 121.14 | 111.57 | 172.56 | 150.90 |
| 1958 | 113.32 | 96.34 | 0.00 | 113.77 | 107.70 | 164.66 | 154.00 |
| 1959 | 113.19 | 97.74 | 0.00 | 113.67 | 112.24 | 160.75 | 149.37 |
| 1960 | 109.57 | 92.19 | 0.00 | 112.47 | 107.41 | 146.99 | 137.38 |
| 1961 | 104.96 | 91.83 | 0.00 | 109.25 | 103.28 | 137.62 | 123.16 |
| 1962 | 112.00 | 98.72 | 0.00 | 115.40 | 111.86 | 154.79 | 134.34 |
| 1963 | 112.17 | 95.10 | 0.00 | 117.24 | 111.71 | 150.66 | 138.80 |
| 1964 | 112.27 | 97.22 | 0.00 | 114.94 | 117.51 | 153.52 | 144.79 |
| 1965 | 110.09 | 97.47 | 0.00 | 114.18 | 111.82 | 141.69 | 135.67 |
| 1966 | 110.49 | 99.05 | 0.00 | 116.71 | 110.20 | 125.76 | 132.15 |
| 1967 | 109.26 | 95.68 | 0.00 | 115.12 | 110.18 | 135.77 | 131.68 |
| 1968 | 129.73 | 117.40 | 0.00 | 135.22 | 128.88 | 149.85 | 154.32 |
| 1969 | 131.63 | 116.01 | 0.00 | 139.25 | 133.02 | 160.72 | 164.17 |
| 1970 | 106.99 | 91.48 | 0.00 | 112.92 | 109.50 | 130.95 | 143.16 |
| 1971 | 114.19 | 103.61 | 0.00 | 124.23 | 111.07 | 129.22 | 139.60 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1972 | 136.17 | 131.24 | 0.00 | 142.02 | 130.14 | 157.15 | 170.02 |
| 1973 | 169.03 | 154.60 | 0.00 | 171.26 | 170.45 | 203.29 | 224.07 |
| 1974 | 137.19 | 115.46 | 0.00 | 146.51 | 146.66 | 179.25 | 201.55 |
| 1975 | 114.78 | 97.55 | 0.00 | 122.24 | 124.08 | 155.51 | 166.41 |
| 1976 | 124.89 | 106.64 | 0.00 | 127.54 | 128.56 | 166.68 | 196.78 |
| 1977 | 139.61 | 119.60 | 0.00 | 146.41 | 142.17 | 167.05 | 231.87 |
| 1978 | 161.27 | 143.34 | 0.00 | 162.77 | 156.03 | 216.63 | 269.07 |
| 1979 | 176.15 | 144.46 | 223.81 | 187.46 | 185.18 | 222.89 | 320.56 |
| 1980 | 143.77 | 115.33 | 209.51 | 151.28 | 168.81 | 184.25 | 222.18 |
| 1981 | 118.21 | 97.68 | 165.77 | 126.16 | 129.19 | 151.50 | 186.82 |
| 1982 | 102.95 | 80.12 | 164.18 | 105.28 | 123.40 | 124.47 | 178.43 |
| 1983 | 102.56 | 94.39 | 138.05 | 108.58 | 127.06 | 127.80 | 210.48 |
| 1984 | 107.64 | 91.58 | 133.84 | 106.73 | 114.83 | 134.33 | 200.53 |
| 1985 | 109.37 | 94.63 | 174.71 | 113.75 | 119.56 | 142.00 | 190.26 |
| 1986 | 120.15 | 103.58 | 197.78 | 116.73 | 137.96 | 169.90 | 195.95 |
| 1987 | 116.19 | 99.73 | 166.29 | 115.94 | 142.56 | 168.38 | 195.50 |
| 1988 | 114.36 | 96.17 | 135.72 | 120.03 | 146.25 | 166.68 | 204.21 |
| 1989 | 108.27 | 93.62 | 131.03 | 123.70 | 156.32 | 160.91 | 156.52 |
| 1990 | 102.50 | 86.63 | 123.68 | 103.01 | 152.33 | 144.46 | 151.63 |
| %/yr'26-90 | **0.53** | **0.27** | 1979-90 | **0.55** | **1.56** | **0.80** | **0.48** |
| %/yr'65-90 | -0.29 | -0.47 | -5.25 | -0.41 | 1.24 | 0.08 | 0.45 |
| | **AV** | **SPRU** | **SSPR** | **DF** | **HEM** | **WHP** | **CED** |

**B.C. DEFLATED SPECIES PRICES**

| YEAR | LJ | TW | BF | REP | PP | YCY | OS |
|---|---|---|---|---|---|---|---|
| 1926 | 71.08 | 69.08 | 57.04 | 0.00 | 76.03 | 178.13 | 0.00 |
| 1927 | 114.09 | 61.85 | 60.66 | 0.00 | 73.63 | 177.88 | 0.00 |
| 1928 | 102.52 | 72.10 | 57.11 | 0.00 | 76.65 | 176.58 | 0.00 |
| 1929 | 116.02 | 66.03 | 53.82 | 0.00 | 72.93 | 173.57 | 0.00 |
| 1930 | 94.04 | 68.96 | 55.05 | 0.00 | 71.45 | 198.35 | 0.00 |
| 1931 | 89.26 | 66.34 | 49.13 | 0.00 | 71.95 | 216.00 | 0.00 |
| 1932 | 97.92 | 61.38 | 57.12 | 0.00 | 67.15 | 85.61 | 0.00 |
| 1933 | 69.05 | 48.15 | 41.79 | 0.00 | 65.77 | 87.38 | 0.00 |
| 1934 | 70.47 | 58.52 | 43.37 | 0.00 | 66.68 | 256.84 | 0.00 |
| 1935 | 74.46 | 60.44 | 47.04 | 0.00 | 64.72 | 190.70 | 0.00 |
| 1936 | 72.68 | 67.62 | 44.64 | 0.00 | 62.80 | 143.76 | 0.00 |
| 1937 | 88.59 | 64.70 | 51.00 | 0.00 | 66.97 | 139.93 | 0.00 |
| 1938 | 68.85 | 61.59 | 50.97 | 0.00 | 66.21 | 141.26 | 0.00 |
| 1939 | 56.94 | 56.78 | 43.05 | 0.00 | 64.50 | 177.66 | 0.00 |
| 1940 | 62.08 | 55.49 | 57.46 | 0.00 | 64.91 | 109.22 | 0.00 |
| 1941 | 53.26 | 61.56 | 55.04 | 0.00 | 69.46 | 119.14 | 0.00 |
| 1942 | 70.22 | 73.64 | 68.87 | 0.00 | 84.65 | 138.46 | 0.00 |
| 1943 | 93.14 | 80.65 | 81.78 | 0.00 | 96.08 | 129.45 | 0.00 |
| 1944 | 81.27 | 85.56 | 98.25 | 0.00 | 97.09 | 173.79 | 0.00 |
| 1945 | 101.69 | 90.01 | 101.26 | 0.00 | 99.15 | 175.73 | 0.00 |
| 1946 | 80.64 | 91.90 | 103.11 | 0.00 | 106.36 | 178.09 | 0.00 |
| 1947 | 88.06 | 95.71 | 116.29 | 0.00 | 110.38 | 183.49 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1948 | 87.97 | 101.48 | 98.72 | 0 00 | 112.99 | 164.15 | 0.00 |
| 1949 | 88.53 | 107.87 | 105.32 | 0 00 | 119.98 | 156.07 | 0.00 |
| 1950 | 94.40 | 122.19 | 123.86 | 0 00 | 145.79 | 145.15 | 0.00 |
| 1951 | 96.47 | 125.22 | 140.80 | 0 00 | 146.90 | 178.76 | 0.00 |
| 1952 | 98.05 | 117.99 | 117.16 | 0 00 | 144.65 | 206.36 | 0.00 |
| 1953 | 92.70 | 109.46 | 104.72 | 0 00 | 135.35 | 184.41 | 0.00 |
| 1954 | 88.95 | 109.33 | 114.07 | 0.00 | 138.58 | 151.92 | 0.00 |
| 1955 | 90.00 | 119.51 | 115.65 | 0.00 | 136.56 | 189.32 | 0.00 |
| 1956 | 88.32 | 115.39 | 96.41 | 0.00 | 123.93 | 178.86 | 0.00 |
| 1957 | 82.71 | 105.61 | 105.18 | 0.00 | 118.53 | 150.76 | 0.00 |
| 1958 | 82.48 | 102.88 | 102.97 | 0.00 | 103.98 | 154.12 | 0.00 |
| 1959 | 81.39 | 103.69 | 108.01 | 0.00 | 111.04 | 155.46 | 0.00 |
| 1960 | 80.20 | 100.29 | 102.37 | 0.00 | 90.03 | 136.00 | 0.00 |
| 1961 | 76.69 | 98.55 | 90.76 | 0.00 | 91.09 | 135.45 | 91.41 |
| 1962 | 88.05 | 104.58 | 102.83 | 0.00 | 100.86 | 143.25 | 74.68 |
| 1963 | 87.25 | 110.14 | 104.65 | 0.00 | 103.73 | 149.97 | 83.47 |
| 1964 | 87.08 | 107.63 | 106.85 | 0.00 | 108.01 | 154.47 | 89.26 |
| 1965 | 88.22 | 108.27 | 110.29 | 0.00 | 99.69 | 150.38 | 88.55 |
| 1966 | 91.30 | 109.91 | 103.15 | 0.00 | 106.62 | 146.30 | 86.12 |
| 1967 | 91.70 | 101.66 | 105.48 | 0.00 | 106.03 | 160.78 | 89.95 |
| 1968 | 113.20 | 120.80 | 131.25 | 0.00 | 118.56 | 204.65 | 99.41 |
| 1969 | 112.27 | 113.69 | 117.55 | 0.00 | 117.40 | 209.59 | 106.75 |
| 1970 | 89.40 | 102.91 | 104.05 | 0.00 | 108.90 | 177.45 | 87.78 |
| 1971 | 105.47 | 122.24 | 109.87 | 0.00 | 106.34 | 190.10 | 86.87 |
| 1972 | 124.41 | 132.99 | 129.38 | 0.00 | 141.11 | 199.22 | 118.68 |
| 1973 | 140.93 | 174.48 | 164.25 | 0.00 | 162.86 | 471.57 | 118.25 |
| 1974 | 100.91 | 154.08 | 136.60 | 0.00 | 103.90 | 518.43 | 120.16 |
| 1975 | 89.35 | 114.70 | 119.86 | 0.00 | 102.26 | 162.73 | 98.62 |
| 1976 | 97.53 | 108.54 | 110.82 | 0.00 | 125.22 | 226.57 | 117.72 |
| 1977 | 113.65 | 148.52 | 123.30 | 0.00 | 118.49 | 281.47 | 0.00 |
| 1978 | 134.82 | 140.10 | 148.97 | 0.00 | 132.33 | 273.30 | 0.00 |
| 1979 | 136.95 | 184.38 | 145.99 | 0.00 | 180.76 | 405.79 | 0.00 |
| 1980 | 110.06 | 142.71 | 110.77 | 0.00 | 127.67 | 371.22 | 0.00 |
| 1981 | 90.03 | 116.38 | 90.33 | 0.00 | 104.18 | 271.52 | 159.83 |
| 1982 | 78.69 | 111.53 | 103.84 | 0.00 | 87.51 | 200.90 | 0.00 |
| 1983 | 45.67 | 106.22 | 97.61 | 0.00 | 75.86 | 226.39 | 146.02 |
| 1984 | 72.48 | 102.98 | 94.40 | 0.00 | 82.43 | 216.69 | 90.50 |
| 1985 | 72.61 | 100.34 | 90.01 | 0.00 | 88.07 | 299.18 | 0.00 |
| 1986 | 79.20 | 98.04 | 98.00 | 0.00 | 88.04 | 350.07 | 0.00 |
| 1987 | 76.36 | 93.64 | 146.34 | 0.00 | 84.09 | 367.25 | 137.54 |
| 1988 | 73.63 | 89.45 | 139.80 | 0.00 | 80.33 | 382.26 | 131.64 |
| 1989 | 71.72 | 85.32 | 128.22 | 0.00 | 76.63 | 316.68 | 137.37 |
| 1990 | 66.27 | 82.66 | 151.23 | 0.00 | 74.24 | 260.64 | 141.26 |
| %/yr'26-90 | **-0.11** | **0.28** | **1.54** | **0.00** | **-0.32** | **1.03** | **0.68** |
| %/yr'65-90 | -1.14 | -1.07 | 1.27 | 0.00 | -1.17 | 2.22 | 1.89 |
| | **LJ** | **TW** | **BF** | **REP** | **PP** | **YCY** | **OS** |

**Canada Deflated Species Prices**

| YEAR | SP | DF | HEM | WHP | CED | LJ | TW |
|---|---|---|---|---|---|---|---|
| 1926 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 1927 | 102.29 | 96.57 | 108.12 | 102.75 | 92.62 | 108.71 | 88.75 |
| 1928 | 103.11 | 97.10 | 104.71 | 101.64 | 101.71 | 103.35 | 104.02 |
| 1929 | 101.69 | 97.18 | 102.57 | 101.02 | 95.06 | 102.86 | 94.67 |
| 1930 | 97.45 | 88.69 | 94.87 | 100.29 | 79.49 | 102.46 | 99.44 |
| 1931 | 87.52 | 76.73 | 99.35 | 95.53 | 71.15 | 93.72 | 96.88 |
| 1932 | 75.18 | 70.30 | 86.30 | 90.08 | 67.86 | 78.72 | 93.93 |
| 1933 | 73.73 | 77.33 | 77.53 | 84.41 | 56.12 | 77.99 | 74.46 |
| 1934 | 77.93 | 88.88 | 77.68 | 89.91 | 65.04 | 84.25 | 85.91 |
| 1935 | 77.26 | 86.67 | 82.56 | 95.26 | 77.01 | 93.88 | 92.03 |
| 1936 | 85.68 | 99.51 | 79.82 | 98.58 | 87.01 | 94.48 | 96.01 |
| 1937 | 92.75 | 111.85 | 93.60 | 102.61 | 101.92 | 100.33 | 93.88 |
| 1938 | 94.76 | 97.59 | 87.06 | 99.46 | 95.89 | 94.83 | 88.75 |
| 1939 | 95.55 | 99.64 | 94.13 | 100.90 | 105.33 | 93.73 | 85.91 |
| 1940 | 106.72 | 110.18 | 117.18 | 105.00 | 119.25 | 102.06 | 85.97 |
| 1941 | 113.54 | 116.67 | 126.33 | 104.88 | 122.39 | 118.43 | 93.05 |
| 1942 | 124.72 | 130.42 | 149.06 | 113.79 | 119.47 | 125.09 | 108.55 |
| 1943 | 144.18 | 140.74 | 160.84 | 127.80 | 129.43 | 134.81 | 118.78 |
| 1944 | 150.95 | 147.48 | 162.25 | 134.44 | 133.50 | 155.44 | 125.27 |
| 1945 | 155.11 | 151.72 | 177.17 | 141.78 | 132.04 | 163.31 | 133.61 |
| 1946 | 157.11 | 179.67 | 206.60 | 152.60 | 153.73 | 167.73 | 142.75 |
| 1947 | 157.32 | 232.83 | 258.15 | 154.98 | 192.95 | 170.53 | 156.19 |
| 1948 | 141.42 | 216.71 | 231.69 | 151.09 | 193.74 | 161.78 | 149.90 |
| 1949 | 139.47 | 193.83 | 208.23 | 150.03 | 185.21 | 149.78 | 153.79 |
| 1950 | 151.57 | 218.01 | 239.54 | 159.68 | 225.06 | 151.02 | 173.90 |
| 1951 | 153.81 | 231.74 | 251.91 | 157.06 | 207.52 | 151.92 | 178.17 |
| 1952 | 150.45 | 208.77 | 234.28 | 157.02 | 152.68 | 159.22 | 168.28 |
| 1953 | 147.95 | 190.53 | 198.27 | 154.92 | 160.93 | 153.49 | 155.91 |
| 1954 | 144.06 | 181.17 | 194.75 | 150.72 | 156.71 | 149.45 | 155.73 |
| 1955 | 143.44 | 187.98 | 205.38 | 153.38 | 161.16 | 146.76 | 170.21 |
| 1956 | 141.89 | 183.17 | 198.02 | 151.99 | 156.93 | 146.19 | 164.23 |
| 1957 | 132.50 | 166.13 | 174.32 | 147.57 | 134.34 | 140.05 | 150.38 |
| 1958 | 126.68 | 156.14 | 168.60 | 145.29 | 137.75 | 136.18 | 146.57 |
| 1959 | 125.44 | 156.56 | 175.11 | 143.13 | 133.18 | 131.12 | 147.61 |
| 1960 | 122.54 | 155.17 | 167.80 | 137.77 | 123.24 | 128.07 | 142.80 |
| 1961 | 124.76 | 150.20 | 161.37 | 137.93 | 111.18 | 129.22 | 140.31 |
| 1962 | 127.88 | 158.15 | 174.38 | 140.11 | 120.95 | 134.06 | 148.89 |
| 1963 | 124.22 | 161.54 | 174.48 | 138.50 | 124.99 | 130.45 | 156.82 |
| 1964 | 125.17 | 158.40 | 182.68 | 143.22 | 130.92 | 130.24 | 153.24 |
| 1965 | 125.70 | 157.46 | 174.19 | 138.27 | 122.80 | 132.98 | 154.15 |
| 1966 | 125.98 | 160.94 | 171.69 | 139.83 | 119.50 | 129.22 | 156.48 |
| 1967 | 124.24 | 158.20 | 171.25 | 140.74 | 119.20 | 130.55 | 144.74 |
| 1968 | 141.29 | 185.95 | 200.93 | 144.14 | 139.68 | 148.08 | 171.99 |
| 1969 | 208.08 | 281.91 | 302.98 | 220.48 | 218.14 | 217.83 | 237.51 |
| 1970 | 117.66 | 155.29 | 170.93 | 143.73 | 129.66 | 120.96 | 146.53 |
| 1971 | 128.07 | 171.43 | 173.46 | 137.86 | 126.35 | 137.77 | 174.05 |
| 1972 | 158.27 | 195.77 | 203.34 | 150.85 | 153.95 | 172.66 | 189.35 |

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|---|---|---|---|---|---|---|---|
| 1973 | 186.17 | 235.83 | 264.86 | 181.40 | 202.70 | 186.57 | 248.42 |
| 1974 | 144.76 | 201.54 | 228.43 | 174.64 | 182.20 | 144.71 | 219.37 |
| 1975 | 125.76 | 167.94 | 194.16 | 155.76 | 150.47 | 127.74 | 163.31 |
| 1976 | 132.54 | 175.86 | 200.43 | 151.33 | 177.93 | 133.82 | 154.58 |
| 1977 | 143.36 | 201.60 | 221.38 | 157.44 | 209.66 | 154.16 | 211.44 |
| 1978 | 168.00 | 223.81 | 243.02 | 175.68 | 243.48 | 182.50 | 199.46 |
| 1979 | 172.15 | 257.95 | 288.00 | 195.95 | 289.77 | 181.56 | 262.52 |
| 1980 | 141.09 | 208.66 | 262.68 | 178.28 | 200.75 | 146.19 | 203.19 |
| 1981 | 122.11 | 173.85 | 201.44 | 162.60 | 169.26 | 123.18 | 165.70 |
| 1982 | 103.58 | 144.81 | 192.74 | 145.90 | 161.52 | 107.91 | 119.32 |
| 1983 | 118.00 | 149.30 | 220.10 | 142.95 | 190.57 | 127.46 | 113.63 |
| 1984 | 114.39 | 147.18 | 171.05 | 158.05 | 181.49 | 121.39 | 221.39 |
| 1985 | 117.35 | 156.33 | 187.23 | 157.34 | 171.68 | 120.28 | 192.37 |
| 1986 | 122.84 | 162.88 | 212.70 | 153.95 | 185.14 | 129.68 | 172.38 |
| 1987 | 118.26 | 164.26 | 216.02 | 164.56 | 177.01 | 124.02 | 164.64 |
| 1988 | 107.55 | 165.23 | 218.66 | 173.94 | 184.65 | 118.90 | 157.28 |
| 1989 | 106.94 | 170.07 | 229.53 | 150.20 | 141.46 | 114.79 | 150.03 |
| 1990 | 102.24 | 169.57 | 229.97 | 143.54 | 137.31 | 106.76 | 145.35 |
| YEAR | SP | DF | HEM | WHP | CED | LJ | TW |
| **%/year** | **0.03** | **0.83** | **1.31** | **0.57** | **0.50** | **0.10** | **0.59** |
| %/yr65-90 | -0.32 | 0.12 | 0.44 | 0.06 | 0.17 | -0.34 | -0.09 |

**Canada Deflated Species Prices**

| YEAR | BF | REP | PP | YCY | OS |
|---|---|---|---|---|---|
| 1926 | 100.00 | 100.00 | 100.00 | 100.00 | |
| 1927 | 107.79 | 100.46 | 96.84 | 0.00 | |
| 1928 | 103.67 | 102.49 | 100.82 | 99.12 | |
| 1929 | 95.76 | 105.67 | 95.92 | 97.44 | |
| 1930 | 93.58 | 102.32 | 93.98 | 111.35 | |
| 1931 | 84.20 | 97.73 | 94.64 | 121.25 | |
| 1932 | 80.80 | 88.66 | 88.33 | 48.06 | |
| 1933 | 68.36 | 81.28 | 86.51 | 49.05 | |
| 1934 | 71.90 | 86.63 | 87.70 | 144.18 | |
| 1935 | 76.51 | 87.49 | 85.13 | 107.05 | |
| 1936 | 78.16 | 91.97 | 82.60 | 80.70 | |
| 1937 | 88.08 | 97.76 | 88.09 | 78.55 | |
| 1938 | 92.31 | 93.13 | 87.09 | 79.30 | |
| 1939 | 88.09 | 99.57 | 88.88 | 104.48 | |
| 1940 | 102.28 | 123.85 | 91.59 | 65.77 | |
| 1941 | 104.79 | 110.59 | 96.01 | 70.28 | |
| 1942 | 122.64 | 121.87 | 114.93 | 80.23 | |
| 1943 | 137.84 | 125.42 | 130.32 | 74.94 | |
| 1944 | 154.74 | 136.18 | 130.61 | 99.78 | |
| 1945 | 161.58 | 141.18 | 135.25 | 102.30 | |
| 1946 | 167.55 | 153.78 | 151.89 | 108.55 | |
| 1947 | 165.94 | 157.71 | 164.29 | 116.56 | |
| 1948 | 146.14 | 155.64 | 153.80 | 95.36 | |
| 1949 | 147.67 | 152.68 | 157.81 | 87.61 | |

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|---|---|---|---|---|---|
| 1950 | 149.11 | 159.43 | 191.76 | 81.48 | |
| 1951 | 165.24 | 158.21 | 193.23 | 100.35 | 192.00 |
| 1952 | 158.75 | 165.78 | 190.26 | 115.85 | 233.20 |
| 1953 | 157.64 | 159.33 | 178.03 | 103.52 | 194.34 |
| 1954 | 150.68 | 159.91 | 182.28 | 85.28 | 0.00 |
| 1955 | 154.22 | 162.67 | 179.62 | 106.28 | 0.00 |
| 1956 | 149.78 | 166.09 | 163.00 | 100.41 | 337.83 |
| 1957 | 147.32 | 158.35 | 155.91 | 84.63 | 0.00 |
| 1958 | 145.24 | 157.50 | 136.77 | 86.52 | 0.00 |
| 1959 | 141.96 | 149.11 | 146.12 | 87.13 | 0.00 |
| 1960 | 139.51 | 145.16 | 118.41 | 76.35 | 135.07 |
| 1961 | 142.19 | 153.34 | 119.81 | 76.04 | 124.30 |
| 1962 | 139.26 | 149.98 | 132.66 | 80.42 | 148.55 |
| 1963 | 139.38 | 147.15 | 136.44 | 84.19 | 123.86 |
| 1964 | 142.04 | 152.58 | 142.07 | 86.72 | 149.40 |
| 1965 | 142.22 | 159.52 | 131.12 | 84.42 | 178.16 |
| 1966 | 137.90 | 158.72 | 140.24 | 82.13 | 125.53 |
| 1967 | 141.96 | 162.18 | 139.46 | 90.26 | 143.94 |
| 1968 | 163.91 | 173.08 | 155.94 | 114.88 | 139.30 |
| 1969 | 222.09 | 260.07 | 226.58 | 172.64 | 221.31 |
| 1970 | 135.46 | 151.55 | 143.24 | 112.22 | 137.30 |
| 1971 | 143.45 | 146.97 | 139.87 | 106.72 | 130.34 |
| 1972 | 170.09 | 161.01 | 185.61 | 111.84 | 157.99 |
| 1973 | 216.67 | 193.31 | 214.21 | 264.73 | 167.76 |
| 1974 | 181.98 | 202.06 | 136.67 | 291.03 | 161.96 |
| 1975 | 162.24 | 176.86 | 134.51 | 91.35 | 150.77 |
| 1976 | 154.36 | 186.84 | 164.70 | 127.19 | 155.92 |
| 1977 | 169.65 | 180.11 | 155.85 | 158.01 | 158.03 |
| 1978 | 184.98 | 186.45 | 174.05 | 153.42 | 188.40 |
| 1979 | 186.46 | 199.88 | 237.76 | 227.80 | 180.94 |
| 1980 | 162.20 | 194.76 | 167.93 | 208.39 | 162.33 |
| 1981 | 139.91 | 190.91 | 137.03 | 152.42 | 161.05 |
| 1982 | 135.44 | 160.12 | 115.10 | 112.78 | 121.55 |
| 1983 | 127.76 | 170.62 | 94.54 | 127.09 | 146.88 |
| 1984 | 134.33 | 156.87 | 153.10 | 121.64 | 0.00 |
| 1985 | 126.02 | 163.49 | 115.85 | 133.53 | 0.00 |
| 1986 | 126.65 | 155.50 | 115.81 | 196.52 | 0.00 |
| 1987 | 131.43 | 144.79 | 141.52 | 206.16 | 231.63 |
| 1988 | 135.55 | 134.76 | 164.73 | 214.59 | 150.66 |
| 1989 | 137.43 | 125.48 | 146.16 | 177.77 | 160.47 |
| 1990 | 143.09 | 118.65 | 116.96 | 146.32 | 128.97 |
| YEAR | BF | REP | PP | YCY | OS |
| **%/year** | **0.05** | **0.56** | **0.27** | **0.25** | **0.60** |
| %/yr65-90 | 0.02 | 0.01 | -0.46 | -0.18 | 0.86 |